ZANZIBAR PROTECTORATE

ANNUAL REPORT

ON THE

DEPARTMENT OF AGRICULTURE

for the year ended 31st December, 1936

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DEPARTMENT OF AGRICULTURE.

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Report on the Department of Agriculture for the year ended 31st December, 1936.

SECTION I.

AGRICULTURE IN THE PROTECTORATE.

GENERAL.

The year 1936 opened inauspiciously for the agriculturists of the Protectorate and for those who derive their incomes indirectly from agriculture, for the clove crop of 1935 had been a poor one, coconuts had been low in price and money was scarce. In anticipation of a poor clove crop during 1936 country people who normally gain a large part of their cash earnings from clove picking increased the area of their food farms and there was also some movement of town dwelling labour to country districts for this purpose. Throughout the year the price of cloves and coconuts rose steadily so that the year ended, if not with general prosperity, at least without acute hardship.

WEATHER.

In commenting upon the rainfall of the year it is that of the clove growing areas which is generally considered, the bulk of the wealth of the Protectorate being derived from the limited area on which this crop is grown. Both in Pemba and Zanzibar the clove region, which is of variable width, runs in a north and south direction generally a short distance inland. The area is approximately parallel to the west coast of the islands and extends inland to the centre. The rainfall of the clove areas proper is over 70 inches per year and the precipitation in Pemba is generally higher than that of Zanzibar. The eastern sides of both islands are drier than the clove areas the rainfall varying from 30 to 50 inches. In the clove areas of Zanzibar the rainfall during the year was above average, the noteworthy feature being a sudden cessation of the main rains in the middle of May and drought conditions in July and October. In Pemba the rainfall was the highest recorded for many years, floods and landslides occurring, but the clove trees did not suffer from these abnormal rains. In both islands the late season or *vuli* rains were light and below normal. Meteorological observations form Appendices I, II and III.

CLOVES.

Seasonal Year.—The clove crop of the seasonal year 1st July, 1935, to 30th June, 1936, was a small one of 298,056 frasilas of 35 lbs., 66,543 frasilas being contributed by Zanzibar and 232,056 by Pemba. In Appendix IV are given the clove arrivals at the Customs godowns during the past 35 seasonal years which approximate to the seasonal production. In Appendix IVA is presented a graph showing average clove crops per seasonal year in five years periods from 1901-06 to 1931-36.

Calendar Year.—The bulk of the 1935/36 crop was harvested by the end of 1935 and it was expected that the year 1936 would bring a change for the better. So far as Zanzibar District was concerned hopes were disappointed, the crop during the year proving to be a small one, in fact, a crop failure on many plantations. On the Government Plantations in Zanzibar the total yield of dry cloves was 306 frasilas in the year 1936, the crop of the seasonal year 1936-37 being completely harvested in this period. In the seasonal years of 1935-36 and 1934-35 the crops were 933 frasilas and 13,193 frasilas respectively. The deliveries of Zanzibar cloves at the Town depôt during the calendar year were 58,850 frasilas, and of Pemba cloves at the Zanzibar depôt 307,991 frasilas making total arrivals during the year 366,841 frasilas.

Harvesting.—In Zanzibar picking commenced in late June and by the end of the year the crop was almost finished. Picking prices which started at 10 cents per pishi measure rose to 12 cents, local labour being adequate for the small crop. In Pemba picking of the early or *mwaka* crop of the 1936-37 seasonal year commenced in the south and centre of the island in July and was completed by the end of October. At the end of the year picking of a late or *vuli* crop was in progress in the northern parts of the island. The cost of picking in Pemba was reasonable throughout the greater part of the harvest period, local labour being supplemented by adequate supplies from Zanzibar. Towards the end of the year, however, the picking price rose to 15 cents of a shilling per pishi and there was an acute shortage of labour for clove harvesting and for agricultural work generally.

**Prices.*—The price of cloves to some extent counterbalanced the shortage of crop, the Clove Growers Association quoting shillings 38 cents 35 per 100 lbs. for Grade I cloves at the beginning of January, the price rising steadily to shillings 58 at the year's end. The mean ex-duty prices paid throughout the year for all grades were shillings 46 cents 44 per 100 lbs. for Zanzibar cloves and shillings 45 cents 35 for Pemba cloves or a weighted mean of shillings 46 cents 30 per 100 lbs. for the total crop against shillings 35 cents 74 per 100 lbs. during the year 1935. The price of clove stems at the Zanzibar depôt remained steady at about shillings 5 cents 85 per 100 lbs. for the first half of the year and at about shillings 7 for the latter half of the year.

Exports.—The export of cloves from the Protectorate was 658,198 frasilas equivalent to 205,687 cwt. valued at shillings 12,373,420 compared with 189,771 cwt. valued at shillings 9,490,260 during 1935. A company to whom a sole licence had been granted commenced distillation of oil from clove stems and clove buds during the year and made a trial distillation from old clove leaves. The quantity and value of oil exported was as follows:—

		lbs.	Shs.
Clove Oil	...	57,633	172,900
Clove Stem Oil	...	4,418	13,260
Clove Leaf Oil	...	338	1,020

Examination and certification of the oil was performed by the Government Chemist.

Inspection.—Under the provisions of the Adulteration of Produce Decree inspection of cloves produced in the island of Zanzibar takes place in the Customs godowns in Zanzibar town, the produce being examined for excessive moisture content and also for excess of extraneous matter. Cloves from Pemba are subject to two such examinations, the first at one of the scheduled ports in the island of Pemba and the second upon arrival in Zanzibar. These examinations take place prior to delivery of the cloves to the exporter. When the exporter is about to ship cloves a final inspection and grading of the produce takes place. In Table I which follows the results of examination of cloves under the Adulteration of Produce Decree are recorded, in Table II the results of inspection and grading are shown.

TABLE I.

EXAMINATION OF CLOVES UNDER ADULTERATION DECREE, 1936.

Origin	Total deliveries in bags of approximately 100 lbs.	Passed (bags)	Failed		% Failure
			For excessive moisture	For extraneous matter	
Zanzibar ...	16,155	15,329	694	132	5%
Pemba ...	108,952	94,513	11,563	2,876	13%

It will be seen that deliveries from Pemba have been almost seven times as great as those from Zanzibar. A further feature of the table is that dampness is the most frequent cause of failures. It is noteworthy, in this respect, that most of the failures for extraneous matter concerned old cloves and that in the case of the 1936 crop hardly a single bag was failed for excess of extraneous matter. This seems to indicate that greater care is being exercised in the

*Prices obtained from the Secretary Manager, Clove Growers' Association.

harvesting and handling of cloves and that it is no longer deemed profitable to attempt their adulteration by the addition or stems or other extraneous matter. All produce was eventually passed after the necessary drying or reconditioning. Facilities for these processes are provided at the places of inspection.

TABLE II.

INSPECTION AND GRADING OF CLOVES FOR EXPORT, 1936.

Month	Number of bales* inspected and graded	Passed Bales	Failed Bales
January ...	3,203	3,203	Nil
February ...	4,142	4,142	Nil
March ...	11,412	11,412	Nil
April ...	13,473	13,473	Nil
May ...	18,432	18,232	200
June ...	8,878	8,868	10
July ...	9,827	9,827	Nil
August ...	12,289	12,289	Nil
September ...	10,188	10,188	Nil
October ...	15,287	15,277	10
November ...	16,748	16,748	Nil
December ...	16,335	16,310	25
Total ...	140,214	139,969	245

*Bales vary from 140 to 196 lbs. according to destination.

The number of failures is negligible. This is only to be expected since most of the cloves had already passed the standards of the Adulteration Decree. In all cases the consignments which did fail were old cloves, possibly even from pre-inspection days. The table also gives an indication of the trend of monthly exports. It will be seen that these started with very light figures in January and February rising to the peak figure of 18,432 bales in May, thereafter dropping to a low figure for June and July and then showing a steady increase up to the end of the year. Table III summarizes exports by grades.

TABLE III.

GRADING OF EXPORT CLOVES, 1936.

Special Grade	Grade I Bales	Grade II Bales	Grade III Bales
Nil	37,669	74,935	27,365
Nil	26%	54%	20%

It is evident that for all practical purposes the Special Grade is not used at all in the local trade. It is also interesting to notice that more than half the cloves exported were of Grade II quality. During the year, as more and more of the clove business was being handled by the Clove Growers Association, most of the inspection and grading shown in Tables II and III was carried out on large bulks of several thousand bags. In this way much time was saved and the system of bulk inspection has proved advantageous both to the C.G.A., their export buyers, and to the staff of the Department. Both the building up of these large bulks and subsequent packing therefrom are carried out under the supervision of the Inspector of Produce. A review of the year's inspection work on cloves indicates that producers are now largely conforming to the quality standards set up by the Adulteration Decree and that grade standards are now firmly established and well understood by clove buyers and the public.

Plantations.—Despite the short crops of 1935 and 1936 and the resultant hardship to plantation owners many clove plantations have been cultivated in a satisfactory manner and systematic replacement of dead trees has been conducted on many estates both in Zanzibar and Pemba. In the latter island

however many of the old plantations which are overgrown with bush remained uncultivated. The demand for clove seedlings raised in the nurseries of the Department in Zanzibar and Pemba again increased substantially, 61,256 plants being purchased by shamba owners against 38,870 during the previous year. It is of interest to record that 19,599 of these seedlings were distributed in Pemba where the number sold was more than double that of the previous year. In Pemba the seedlings are raised in nurseries distributed throughout the clove areas. In Zanzibar the bulk of the supply is grown at Kizimbani Experiment Station, a second nursery capable of accommodating 7,500 seedlings having been erected at Dunga during the year and seedlings established for planting out in the rains of 1937. It is intended to decentralize from Kizimbani to a greater extent by increasing the number of outside nurseries with a view to increasing the radius of distribution of selected seedlings. The incidence of "sudden death" in certain areas of mature trees was evident and die-back in neglected plantations was common. Mortality as high as 30% in one-year-old plants, which may be due to chafer or to white ants, was experienced in some localized areas where attempts were made to re-establish young cloves on land from which old clove trees had recently been cleared.

COCONUTS.

General.—The coconut is of very great importance to the internal economy of the Protectorate the nut being used as food and as currency amongst owners of a few trees who barter nuts for other commodities in the small shops in country districts. An outstanding feature of the year from the point of view of the local community was the welcome rise in the price of coconuts and coconut products the total value of all which was Shillings 2,935,920 constrasted with Shillings 2,455,704 for the previous year.

Exports.—The crop in those of the Government Plantations on which accurate comparisons are possible indicates that the production of nuts was between 5% and 10% below that of the year 1935, but the improved prices more than counteracted this and stimulated export at the expense of local consumption, the domestic export of copra being almost 1,000 tons greater than the previous 5 years' average and oil exports being approximately two and half times greater than the average of the same period. The value of coconut products was derived as follows:—

Item		Unit	Quantity	Value in Shs.
Copra	...	Tons	13,037	2,853,720
Coconut Oil	...	lbs.	167,664	33,320
Coconuts	...	Nos.	1,024,057	48,880

A feature of the year's trade was the opening to Zanzibar copra of markets which had formerly found it unacceptable on account of its poor quality. India, Holland and Germany imported approximately 1,500 tons of white hot-air-dried copra which was the subject of favourable comment.

Prices.—The price of coconuts rose steadily throughout the year from about Shillings 20 per 1000 to as high as Shillings 60 per 1000. On Government Plantations the average price received for nuts was Shillings 29 cents 11 per 1000, the majority of the nuts being sold at the beginning of the year when prices were low. The local price of copra varied between Shillings 9 and Shillings 11 per 100 lbs. for the first eight months of the year and rose to Shillings 12 during October. In November and December the price rose sharply to Shillings 17 cents 86 per 100 lbs. Over 300 tons of copra from Government Plantations sold at various periods during the year averaged Shillings 10 cents 63 per 100 lbs. equivalent to Shillings 238 cents 11 per ton. 6,219 nuts were required to make one ton of copra, the value of these at the average price being Shillings 181 cents 03. Some interesting data on this subject is contained in the detailed report of the Manager of Government Plantations which is submitted as Appendix V.

Copra Making.—For a considerable time officers of the Department of Agriculture have endeavoured to persuade copra makers to store nuts in the heap to allow them to mature fully before turning them into copra. With the growth of kiln drying it is gratifying to be able to report an increase in the

number of shamba owners and copra makers who follow this practice. Throughout the year a campaign to stimulate the production of better copra and the erection of kilns more efficient than the ordinary smoke drying type was conducted and a great improvement in copra quality was noticeable by the end of the year. Two enterprising exporters erected large batteries of kilns in Zanzibar and many smaller copra makers made commendable efforts to improve the standard of copra which they produced. By the end of the year more than 25% of the copra made by small producers was kiln dried. Arising out of records kept in connection with copra defects it has been confirmed that over two-thirds of the copra exported from the Protectorate is produced in Zanzibar District and that the Mudirias of Magharib and Koani account for some 60% of the Zanzibar production.

OTHER AGRICULTURAL ITEMS.

Fruit.—Exports during the year were valued at Shillings 38,220 a decrease in value of Shillings 16,275. The bulk of the export consisted, as in previous years, of oranges. Considerable interest has been taken by the public in fruit cultivation, 354 budded orange plants and smaller numbers of other fruit trees being purchased from the Department during the period.

Tobacco.—The interest in this native industry was maintained during the period, the export of 47,650 lbs. valued at 12,920 Shillings being an increase of 4,469 lbs. and a decrease of 751 Shillings in value.

VETERINARY.

Cattle Imports.—The imports of slaughter and dairy stock are tabulated below, the comparative figures for the years 1932, 1933, 1934 and 1935 being presented.

TABLE IV.

IMPORTS OF LIVE STOCK.

Description	Calendar Year.				
	1932	1933	1934	1935	1936
Oxen ...	3,150	2,150	1,546	1,871	1,537
Cows ...	156	209	248	93	53
Calves ...	127	142	181	45	33
Goats ...	9,850	6,006	3,661	6,548	6,514
Sheep ...	3,191	2,236	1,660	1,170	1,513
Pigs ...	—	—	—	2	5
Totals ...	16,474	11,643	7,296	9,729	9,655

The bulk of the oxen, sheep and goats are slaughtered soon after arrival, the imported slaughter stock being supplemented by a number of local animals. The Protectorate, however, could carry a much greater population of live stock than it does, but the absence of easily available supplies of water in the country districts militates against this.

Poultry.—There was no serious outbreak of disease amongst animals other fowls during the year. Fowl cholera broke out in Zanzibar District and as a result the movement of fowls between Zanzibar and Pemba was prohibited. The owners of fowls are very lax in the matter of restricting the movement of fowls from infected to clean areas and, as a result, the effects of the disease are generally severe when it occurs. The unhygienic manner in which the majority of fowls are housed in illventilated uncleaned houses assists in the rapid spread of this disease. The stock of Rhode Island Red poultry maintained at the Experiment Station in Zanzibar, was visited frequently by the public, 87 cockerels being distributed and 2,000 hatching eggs sold.

Town Dairies.—A series of fenced paddocks was erected in the Government Plantation at Mtoni and a start made with the evacuation of all privately owned dairy cattle from within the Town boundaries of Zanzibar. The activities of this section of the Department were hampered by the fact that no Veterinary Officer was available during the final months of the year. The local dairymen

in the town area supplement the natural grass diet of their in-milk cows by supplies of cassava and sim-sim meal and animals are kept in good condition. There is, however, a marked tendency to wean calves early and to neglect them, the majority of animals in their first year of life presenting an unthrifty appearance.

SECTION II.

WORK OF THE DEPARTMENT OF AGRICULTURE.

GENERAL.

Field Staff.—The organization of extension work was further advanced during the year, attention being directed principally to propaganda and advisory work in connection with copra which was undertaken by the Produce Inspection Staff in Pemba District and by subordinate staff detailed specially for District work in Zanzibar. The effects of the work of this staff are clearly visible in both islands in the improved quality of copra and in the large number of copra kilns which have been constructed. It may be of interest to record the steps which have been taken and are still being taken to consolidate the ground gained. Under the provisions of the Adulteration of Produce Decree all copra arriving at the scheduled ports of Pemba is examined for moisture content or decomposed matter, the unsatisfactory copra being detained until it has been re-dried or picked over as the case may be. This copra is re-examined, prior to sale, upon arrival in Zanzibar. Copra produced in Zanzibar is examined in the town copra market for the same defects. The names and addresses of those whose copra has failed to pass these simple standards are taken and visits are made to their premises by a member of the Department of Agriculture and such advice and instruction given as is necessary. When the defects are due to faulty technique an experienced copra maker is lent for a week and where kiln construction is faulty, assistance is given in reconstruction. Financial aid for the latter purpose is given to approved applicants

Agricultural Show.—A successful agricultural show, the first of its kind in the Protectorate, extending over a period of three days was held at Kizimbani Experiment Station in September, several thousand people attending. The Department's exhibits of graded produce and of copra manufacture by different methods in different types of kilns aroused particular interest and induced many to return for further information.

EXPERIMENT STATION.

Clove Nurseries.—The supply of clove seedlings derived from high yielding parents is a routine measure at the experiment station in Zanzibar. Further nurseries for this purpose were constructed during the year, four in Pemba and one in Zanzibar, to meet increasing public demands.

Regeneration of Cloves.—The regeneration of cloves by a variety of methods has been the subject of comment in previous reports. It is now possible to record certain tentative conclusions as a result of these trials. On land which had carried old cloves and which had been clear felled and put down to food crops on ridges a satisfactory stand of robust young cloves has been obtained, these having benefited by the shade of the interplanted cassava and by the deep cultivation given in preparing the ground for this crop. On similar clear felled areas, in which the clove seedlings were established under the side shade of closely planted lines of *Tephrosia candida*, seedlings showed a higher mortality rate than those in the area grown under food crops. Contrasted with seedlings grown without any shade the growth rate of those grown in the shade of *Tephrosia* was greater in the first year, but in the second year the unshaded seedlings caught up and exceeded in growth those under *Tephrosia*. The progress of interplanted seedlings established under the shade of mature trees continues to be satisfactory. The clove seedling responds to clean ring cultivation and is benefited by shade during the first year of its life in the field, a suitable form of shade during this period being interplanted cassava. It appears possible that after clear felling stands of old cloves it may be advantageous to put the land down to food and green manure crops for a few years before replanting cloves in order to free the land of root debris and restore fertility.

Tree Canopy and Yield.—As the clove carries its crop of buds at the branch terminals, it was considered probable that, in a group of trees of uniform age and height, total yield per tree would be directly related to the superficial leaf area and branch equipment of the tree. In a plot containing 500 mature clove trees of which individual yield records were available for the past three clove seasons, a survey of the trees was carried out and a classification made in eights of a full or perfect canopy. The data is presented below in Table V together with the yield figures. The average yield of all trees was 8.9 lbs. of dry cloves per year.

Table VI.

ANALYSIS OF YIELD BY CANOPY CLASS OF 500 MATURE CLOVE TREES (3 YEARS PERIOD).

Fraction of a Full Canopy in eighths	Number of Trees	Percentage of Trees	Yield in lbs. of Dry Cloves per year
8/8	9	1.8	13.1
7/8	152	30.4	10.8
6/8	305	61.0	8.3
5/8	27	5.4	5.8
4/8	4	0.8	2.6
3/8	3	0.6	4.6
	500	100.0	

A brief scrutiny of the figures reveals the fact that the yield of cloves is, in fact, related to the canopy classification, yields diminishing as the canopy decreases. In the three and four eighth classes the number of trees, 7 out of 500, is too small for reliable comparisons to be made.

Sudden Death.—A small hand pump ejecting water under pressure was used to expose the roots of a tree which had succumbed to "sudden death". A limited amount of damage due to insects and hoe cultivation was observable, but, in many cases this had calloused over, and this was regarded as unlikely to have been the final cause of death. The most striking feature of the exposure was the great length (over 30 feet) of the principal lateral roots and the absence of branches and fine feeding roots beyond a circular area some eight feet in radius from the tree. The root system of a healthy tree exposed in a similar manner showed the presence of fine feeding roots along the entire length of the main laterals. It is apparent that this condition requires investigation by a specialist.

Die-back.—In an unthrifty tree with symptoms of "die-back", root exposure showed conditions similar to those of the tree suffering from sudden death except that damage by insects, probably clove chafer, was more pronounced, but this was apparently secondary as callousing of the extensively damaged areas did not occur. Symptoms of "die-back" have been produced in pot cultures when cloves are grown in a medium deprived of potash and phosphate and also where competing grass growth is allowed to develop in the presence of a full nutrient solution. The similarity in root degeneration of cloves suffering from "sudden death" and from die-back" is striking, but whereas the "sudden death" trees are, as a rule, apparently healthy and carry complete foliage dying within a short period, sometimes a few days, of the first symptoms of the condition becoming noticeable, "die-back" trees are unthrifty and lacking in foliage and persist in this state for years.

Ants.—During the year attempts were made to free clove trees of the red ant *Oecophylla smaragdina* which is of considerable inconvenience to clove pickers. A number of trees were grease banded in an effort to prevent the workers from foraging on the ground for food, and on other trees, in addition to grease banding, grease paper bags containing Capex ant poison were placed in the crotches of branches above the band. Briefly, it may be stated that the

trees with poison bait above the band were freed of ants after a period of about two months, while those on which grease banding alone was employed appeared to require several months more, and even then it was not certain that the trees were entirely free of ants. The latter part of the trial will be repeated.

Clove Chafer.—Clear evidence of damage to clove roots by larvæ of chafers has been found from time to time and specimens of these insects have received a variety of names from entomologists. It appears that we are dealing with more than one insect of which one only may be the destructive form, and this may, to some extent, explain the apparently conflicting results which have been obtained in trials. Chafer larvæ were introduced into pots in which clove seedlings were planted. Some of the seedlings were killed rapidly, the insects ring-barking the seedlings in a manner which had been previously ascribed to white ants. On the other hand certain plants were undamaged, the insect completing its metamorphosis without apparent damage to the seedlings. A series of forms was bred out and sent to the British Museum for identification.

Nutrition Deficiencies.—The nutrition deficiencies trial reported upon in 1935 was, with minor modifications, in course of repetition during the year.

Pollination Observations.—A preliminary trial was made at bagging clove inflorescences in order to determine whether the clove was self or cross fertilized. Cylinders of cellophane plugged at either end with non-absorbent cotton wool, proved weather proof and were intact at the end of the short rains. Many buds inside the bags abscissed but a few produced secondary development of the fruit to the swollen magenta coloured stage. No fruits reached complete maturity, but now that the technique of bagging is understood a large scale trial will be undertaken.

Coconuts.—The individual harvesting of 300 selected palms was continued, the mean yield per tree being 66.7 nuts compared with 123.8 in 1935. The seed from 34 palms of outstanding performance was sown in nursery beds at the year's end. Two blocks of uniform coconuts which have been harvested by individual trees over a period of three years have now been put down to a simple trial to determine the profitability of artificial manuring. The treatments are simple, consisting of

1. One hoeing annually plus fertilisers.
2. Two slashings annually plus fertilisers.
3. One hoeing annually and no fertilisers.
4. Two slashings annually and no fertilisers.

The dressing of fertilisers consists of a mixture of 3 of Sulphate of Ammonia, $1\frac{1}{2}$ of Superphosphate and 3 of Muriate of Potash applied at the rate of 10 lbs. and 5 lbs. per tree.

Copra Kilns.—In addition to the sand bath kilns which have been in use for some years two further types of simple copra driers producing white copra were erected during the year and proved successful. A simple unit of each is described briefly below. The first consists of a square shed $12\frac{1}{2}' \times 12\frac{1}{2}'$ made of galvanized iron sheets 8′ high with a similar roof. Four built in shelves of wire net each shelf $2\frac{1}{2}'$ wide and 18″ apart run round the walls of the room and on these the half nuts are placed. Heat is supplied by means of a furnace made from a 40-gallon oil drum provided with a sheet iron chimney which is led through the roof. A small firing door is made in the drum, and husk and shell fuel is used. The small furnace makes frequent firing essential but, provided that care is taken, a good copra can be prepared in three days, the kiln having a capacity of 1,500 to 1,800 nuts. In this case no special provision is required for ventilation the percolation of air between the joints in the iron sheets of the walls proving adequate for this purpose. If wattle and daub construction and a thatch roof are employed it is necessary to provide a ventilated ceiling and to take the chimney out of the side wall. The amount of ventilation which consists of a hole or holes in the ceiling is determined by trial, but a central hole $1\frac{1}{2}$ feet square is, normally, adequate.

The second type consists of a chamber of varying size, generally $8' \times 8'$ or $10' \times 10'$, in which heating is performed by a furnace similar to that described above. The chimney is taken out through a side wall. The single copra tray which is made of expanded metal is about 4' above the furnace and is provided with a heat spreader of sheet iron hung midway between the copra tray and the furnace. A series of these units can be erected and copra turned over into a fresh tray each day. A unit 10' square will take 2,000 to 2,500 nuts and drying can be accomplished in from three to four days.

Citrus.—A block of citrus budded on rough lemon stock consisting of grape fruit derived from South African parent trees, and oranges from locally selected trees was established. Of the original importations of South African grape fruit the Cicely, Foster, and Pernambuco varieties were the highest yielders during the year.

Oil Palms.—A block of one and a half acres of the Deli type was successfully established during the year and made good growth.

Kapok.—A small plot of Kapok derived from seed obtained from Java was planted out in the late rains and established successfully.

Rice.—Thirty two local varieties of rice were collected and sown in small beds for observation on uniformity, flowering time, tillering and strength. The majority were only represented by a few lines so that yield figures are not valuable. However, it has been possible to reduce the numbers of useful local varieties by discarding and by grouping the same varieties collected under different local names.

Cassava —Some 38 cassava varieties were on trial during the year including local varieties and importations from Amani and Java. Observations upon growth, yield, sweetness and resistance to mosaic disease were made and 16 varieties were selected for replanting. During the year small supplies of some of the more promising varieties were issued to local cultivators.

In 1935 a trial was laid down in which randomised blocks of three planting times, namely March, August, and October, were divided into randomised plots one series of which was untreated and the other treated by the removal —4 times at intervals of 2 weeks—of all virus infected plants. The first rogueing took place when the cassava was two months in the field. Analysis of the results shows that August planted cassava yields better than March planted which may be due to chance once in twenty times. No significant difference was observable between treatment and control plots but this may be due to the fact that the final rogueing of virus infected plants took place when growth was well advanced, and thus from the point of view of yield it might have been advantageous to remove infected plants on two occasions only.

A crop of cassava, taken off land which had been limed in 1934 and had since carried crops of maize, mucuna and Bambarra groundnuts, showed that the plots originally limed at 5 tons per acre gave a better yield than the unlimed plots, which might be due to chance once in 100 times, and that the plots which had received 20 tons of lime per acre gave a better yield than the unlimed plots, which might be due to chance once in 20 times. The plots limed at 10 tons per acre gave an insignificant increase compared with unlimed plots. The relevant data is shown below :—

Treatment		Yield per acre in lbs.
No lime	...	2,059
5 tons per acre	...	2,543
10 tons per acre	...	2,312
20 tons per acre	...	2,454

Maize.—A trial with maize, in the light rains, on land which had been treated with compost and cattle manure yielded as follows :—

$2\frac{1}{2}$ tons compost per acre	...	704 lbs. per acre cobs.
5 tons compost per acre	...	748 lbs. per acre cobs.
$2\frac{1}{2}$ tons cattle manure per acre	...	1,344 lbs. per acre cobs.
5 tons cattle manure per acre	...	1,460 lbs. per acre cobs.

An importation of Maratha maize from the mainland was sown on untreated observation plots and the best cobs selected and planted in the light rains at the end of the year. The yield was at the rate of 1,492 lbs. of grain per acre the grain being similar in appearance to that already grown on the station.

Miscellaneous.—A collection of local Yams was made for trial. A small plot of arrowroot was grown and yielded at the rate of 7,228 lbs. per acre. Rhizomes were issued to certain growers in the south of Zanzibar where starch making is practised.

GOVERNMENT PLANTATIONS.

The Government Plantations were cultivated regularly during the period. The report of the Manager indicates clearly that the clove crop provides a badly distributed and uncertain income, bumper crops and resultant spells of prosperity being followed frequently by negligible crops and periods of hardship to those who do not make savings in the good years. Coconuts on the other hand provide a well distributed income but are subject to considerable price fluctuations. Over the four year period 1933 to 1936 inclusive the Government Plantations, taken as a whole, made a profit, although those of the plantations which consist almost entirely of coconuts showed a loss. These coconut plantations however made a profit during the year 1936 on account of good prices. During the same four year period the plantations which are almost half and half cloves and coconuts have shown a satisfactory profit in spite of low prices for cloves and coconuts during a large part of the period, and in spite of poor crops of cloves during 1935 and 1936. It is of interest to note, however, that these plantations did not make a profit during 1936, the revenue derived from the coconuts being insufficient to make up for the expenditure in cultivation, etc. in the absence of a clove crop of even moderate dimensions. One plantation carrying a proportion of one clove tree to four coconut trees produced an annual profit throughout the period.

GOVERNMENT CHEMIST.

General.—The report of the Government Chemist which forms Appendix VI reveals the diversity of calls which the Chemist has to meet. The time which this officer can devote to agricultural investigations is limited on account of the large number of analyses, arising from the requirements of legislation, which he is called upon to perform for various Departments of Government, and this condition is likely to persist until an additional trained subordinate is provided.

Clove Storage Trial.—In the course of the year the Chemist summarized the results of a three years' storage trial on cloves, the trial having been designed to ascertain what changes, if any, took place during prolonged storage and how these changes were affected by the quality and initial moisture content of the cloves and by the conditions of storage. The experiment is being continued, but it is considered of interest to record the conclusions which are apparently justifiable at this stage.

(1) Cloves, when stored for a considerable time, lose weight not only through evaporation of moisture but through loss of oil and solid matter.

(2) Under dry conditions of storage, with good ventilation, loss of moisture is rapid at first and then slows down until equilibrium is reached, with the prevailing atmosphere in Zanzibar, at a moisture content of about 10 per cent.

(3) Under damp conditions of storage, without ventilation, loss of moisture is slower and dry cloves may even absorb moisture.

(4) Loss of oil is more rapid under damp and unventilated conditions of storage.

(5) Even after three years in store the oil content of cloves will rarely be less than 17 per cent, the characteristics of the distilled oils remaining fairly constant.

(6) There is some evidence that the loss of volatile oil is not due entirely to vaporisation, but partly to oxidation and other changes leading to non-volatile products which in one case resulted in an apparent increase in solid matter.

Agricultural Education.—A further course of training in agriculture was given to school teachers on vacation, the course being held at the experiment station in Zanzibar. The instruction of pupils who will form the subordinate field staff of the future was put on a more systematic basis during the year, lectures in agriculture, botany, and elementary surveying being supplemented by field work. In addition, the general education of pupils was improved as a result of teaching in English, arithmetic and nature study given by the staff of the Education Department to whom we are greatly indebted for this help.

Public Gardens.—The Public Gardens, open spaces and roadside avenues in the town area were maintained in good condition and a piece of derelict land in front of the Bet-el-Ajaib was made into a public garden in commemoration of the Silver Jubilee of H. H. the Sultan. The Superintendent of Gardens, gave regular instruction in botany to pupils at the experiment station.

Publications.—Memoranda on Essential Oils in Zanzibar, The Copra Industry in East Africa, Food Crops in Zanzibar Protectorate, and Citrus Production in Zanzibar were submitted to the Conference on Co-ordination of Agricultural Research in East African Territories. A paper entitled Poultry Progress at the Kizimbani Experimental Station, 1932-1935, by Mr. F. B. Wilson, Agricultural Officer, was published in the East African Journal of September, 1936. Two papers were prepared by the Government Chemist and published during the year. The first, entitled The Thiocyanate Test for Soil Reaction—A modified Technique and a method of Recording Results, appeared in the Journal of the Society of Chemical Industry, Volume L.V., 1936. The second, Studies on the Clove Tree and its Products. I. The Estimation of Essential Oil in Cloves, etc., appeared in The Perfumery and Essential Oil Record of October, 1936.

SECTION III.

FINANCIAL STATEMENT.

The expenditure and revenue of the Department are summarized below, expenditure having been reduced by over 30,000 shillings compared with the previous year, and revenue by approximately 130,000 shillings. The greater part of the reduction in revenue was due to the failure of the clove crop, receipts from sales of cloves being some 126,000 shillings less than in the previous year.

EXPENDITURE.

Item		Amount Shs.	Cts.
Personal Emoluments	...	267,076	03
Other Charges	...	196,836	85
Special	...	24,820	96
Total	...	488,733	84

REVENUE.

Item		Amount Shs.	Cts.
Sale of Cloves	...	27,495	08
Sale of Copra and Coconuts	...	133,152	68
Produce Inspection Fees	...	13,409	35
Miscellaneous	...	19,952	68
Total	...	194,009	79

Portions of the Government Plantations in Zanzibar and Pemba were disposed of during the year, the value of sales in Zanzibar being 72.512 shillings 92 cents and in Pemba 1,449 shillings 26 cents.

SECTION IV.

LEGISLATIVE CHANGES AFFECTING AGRICULTURAL INDUSTRIES.

Under the provisions of the Customs Management Decree, Cap. 119, the export, except under licence, of clove stems was prohibited as from 1st January, 1936, a company having been granted a license to distil oil from clove stems and buds within the Protectorate. The bulk of the stems which came on to the market during the year were purchased, in the first instance, by the Clove Growers Association and re-sold to the Company operating the distilling plant, no marked fluctuations in the price of stems occurring. There was no export of stems during the period.

J. C. MUIR,
Acting Director of Agriculture.

APPENDIX I.

METEOROLOGICAL OBSERVATIONS, 1936.

Rainfall and Relative Humidity, Zanzibar.

Months	Selem		Kidichi		Machui		Mkokotoni		Mukunduchi		Chwaka		Town			Kizimbani			Dunga			Chukwani		
	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %
January	5·54	12	4·97	14	5·31	12	0·47	4	6·08	15	3·18	12	5·75	10	78	5·30	11	86	5·56	14	85	3·74	11	83
February	6·27	11	5·25	12	5·29	12	1·79	5	4·20	6	8·37	8	10·70	9	77	6·51	12	89	7·22	13	85	4·25	10	85
March	4·51	11	4·26	16	8·07	14	0·98	5	3·09	5	2·79	7	3·25	5	78	4·81	15	80	4·13	18	86	3·20	13	82
April	17·91	21	18·73	24	19·11	23	6·84	19	9·43	18	23·76	19	19·88	19	83	18·98	22	88	20·75	21	91	15·39	20	90
May	13·29	16	12·39	18	14·64	18	6·11	15	7·33	17	14·88	17	11·51	13	86	14·37	16	85	16·48	18	89	7·80	16	89
June	6·61	13	6·48	15	6·58	14	2·48	10	5·70	18	9·70	11	8·22	9	79	6·64	14	86	7·23	16	86	6·62	13	86
July	0·04	2	0·24	4	0·83	6	0·23	4	0·37	4	0·29	2	0·00	0	80	0·33	2	82	0·42	6	87	0·00	0	86
August	5·50	9	4·13	11	5·57	11	1·29	10	0·65	6	1·17	4	1·78	3	79	6·55	9	83	3·37	4	85	1·82	6	86
September	2·84	11	2·11	15	3·80	14	1·68	9	0·19	4	1·15	5	2·79	8	78	3·84	12	79	3·45	12	81	2·01	9	84
October	1·35	7	1·63	8	2·07	7	0·41	3	0·13	2	0·56	2	0·73	3	75	3·19	7	76	2·56	6	79	0·14	4	81
November	3·74	11	5·97	15	2·46	11	0·60	4	0·16	3	0·19	3	5·76	11	74	5·40	11	74	5·15	11	79	7·79	15	80
December	5·31	13	8·29	13	7·95	13	3·47	6	2·62	11	6·41	11	6·78	13	76	7·96	13	78	8·68	15	79	6·45	16	84
Total 1936	72·91	137	74·45	165	81·68	154	26·35	94	39·86	109	72·45	101	77·15	103	79	83·88	144	82	85·00	154	84	59·21	133	85
Total 1935	83·41	171	80·46	168	83·06	154	30·41	136	68·49	138	54·10	90	111·89	121	80	82·36	175	81	87·12	168	84	66·24	150	85

Note:—Rainfall in inches

APPENDIX II.

METEOROLOGICAL OBSERVATIONS, 1936.

Rainfall and Relative Humidity, Pemba.

Month	Wete		Mkoani		Mtambili		Kigomacha		Matangatwani		Wesha			Fufuni		
	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Rain	Wet Days	Average Relative Humidity %	Rain	Wet Days	Average Relative Humidity %
January ...	2·10	3	3·57	14	8·23	20	1·25	6	+	+	5·04	13	78	7·19	14	84
February ...	3·00	5	2·07	12	6·15	20	2·02	5	+	+	4·27	12	78	4·15	17	80
March ...	3·43	15	1·41	13	3·44	16	2·86	3	+	+	3·46	11	72	1·32	10	78
April ...	28·98	26	28·71	25	34·86	27	27·60	19	+	+	28·69	23	82	26·56	25	87
May ...	34·71	22	26·57	18	36·66	24	37·45	19	34·03	21	33·63	19	+	34·88	20	85
June ...	14·82	27	17·96	19	20·58	27	17·54	21	17·07	26	17·26	24	82	18·46	20	85
July ...	2·25	16	1·33	6	2·16	11	3·58	11	2·82	17	0·85	6	79			
August ...	1·61	9	2·21	5	3·42	11	2·30	11	3·24	13	1·39	3	79			
September ...	2·42	17	1·63	9	2·26	14	4·07	10	2·60	14	1·31	6	77	No	records	
October ...	3·38	16	2·28	6	1·71	10	3·22	9	1·00	15	0·53	6	76	Station	closed	
November ...	4·30	13	2·05	15	2·99	17	2·51	5	4·21	13	2·37	10	77			
December ...	5·14	16	3·21	12	6·92	16	3·13	7	4·13	15	1·79	14	79			
Total 1936 ...	106·14	185	93·00	154	129·38	213	107·53	125	+	+	100·59	149	78			
Total 1935 ...	77·43	130	93·26	144	+	+	72·41	134	+	+	75·88	174	79	82·12	167	79

Note: –Rainfall in inches. + No records.

APPENDIX III.

METEOROLOGICAL OBSERVATIONS, 1936.

Temperatures.

Months	ZANZIBAR.								PEMBA.			
	Town		Kizimbani		Dunga		Chukwani		Wesha		Fufuni	
	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.	Mean Max.	Mean Min.
January ...	84·8	80·4	86·3	74·2	86·7	74·4	88·7	76·5	87·0	75·5	87·2	74·2
February ...	85·8	80·2	87·6	72·7	87·9	72·5	89·3	76·0	88·1	75·8	87·2	73·6
March ...	89·3	81·8	88·1	74·0	88·0	73·5	90·7	77·4	90·3	76·5	88·7	75·0
April ...	84·4	77·3	84·0	73·0	83·3	73·3	85·4	75·8	84·7	75·3	83·8	74·9
May ...	83·6	76·5	83·8	71·6	82·9	71·3	83·7	75·1	+	+	82·8	73·3
June ...	81·8	74·7	82·2	70·8	79·6	70·5	81·4	73·5	+	+	80·9	+
July ...	82·3	74·2	82·4	68·5	80·5	67·9	81·6	72·8	81·2	71·1		
August ...	81·8	73·3	82·1	67·2	78·2	65·6	81·5	71·6	81·9	69·7		
September ...	82·7	73·8	82·7	67·8	78·1	67·1	83·1	71·7	84·3	69·9	No records	
October ...	85·1	76·6	84·8	67·7	85·1	67·4	87·9	73·1	87·9	71·5	Station	closed
November ...	87·6	79·2	86·8	71·6	87·9	70·8	89·0	75·2	88·9	73·6		
December ...	87·7	80·3	87·4	73·3	88·7	73·4	88·3	75·9	90·7	74·4		
For the Year ...	84·7	77·4	84·9	71·0	83·9	70·6	85·9	74·6	86·5	73·3		

Note:—Temperatures in Degrees Fahrenheit. + No records

APPENDIX IV.

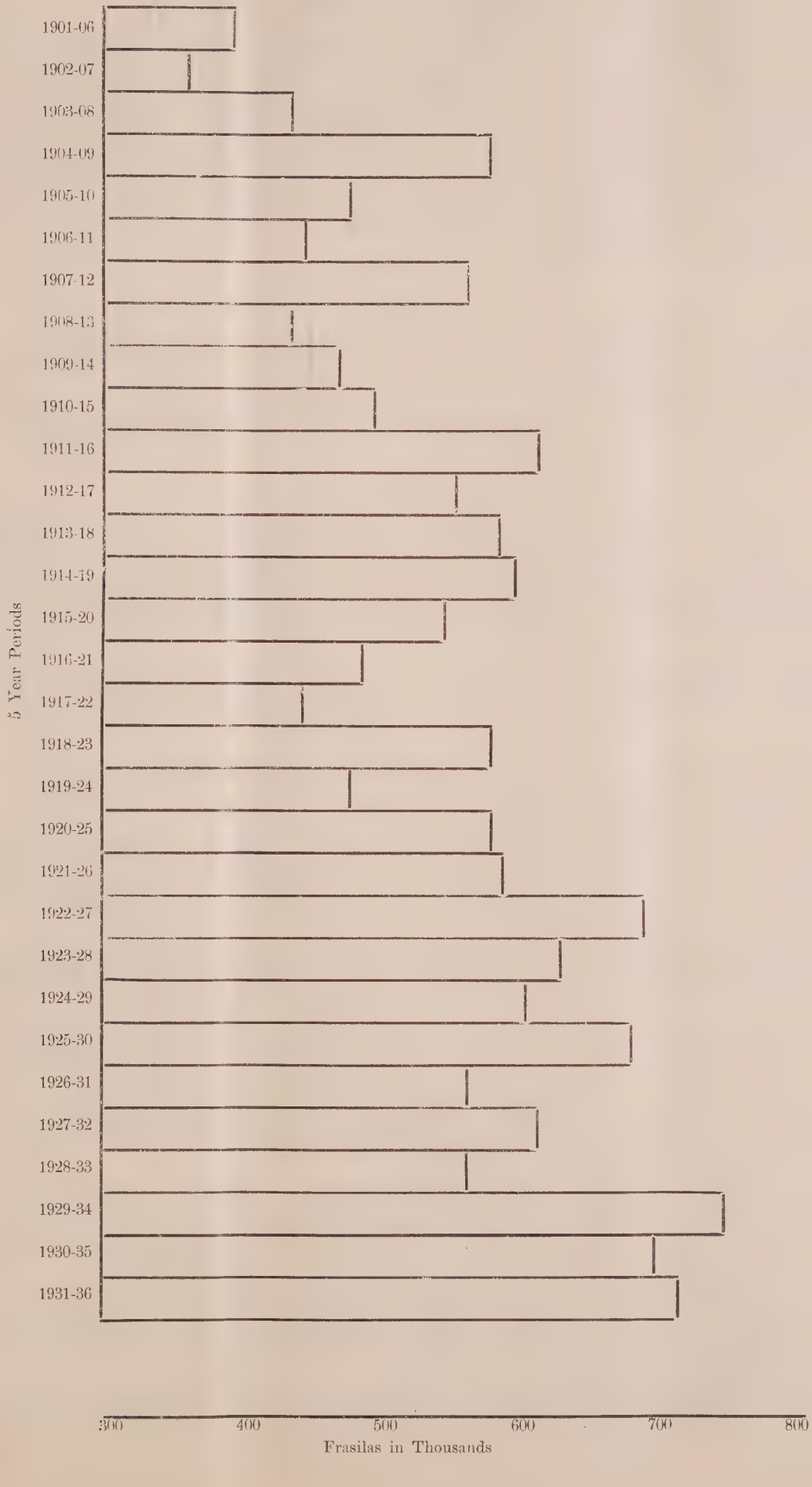
Approximate Production of Cloves in Frasilas of 35 lbs. for 35 Crop Years. (1st July to 30th June).

(Based on receipts of cloves at the Customs Clove Depôt).

Season	Zanzibar	Pemba	Total	Mean Crop per season in five year periods
	Fras.	Fras.	Fras.	Fras.
1901/02	44,000	333,000	377,000	—
1902/03	172,000	252,000	424,000	—
1903/04	27,000	99,000	126,000	—
1904/05	81,000	654,000	735,000	—
1905/06	178,435	129,735	308,170	394,000
1906/07	63,004	203,496	266,500	371,800
1907/08	213,662	541,993	755,655	438,000
1908/09	165,727	449,691	615,418	576,000
1909/10	109,678	300,047	409,725	471,000
1910/11	52,100	139,307	191,407	448,000
1911/12	216,507	582,153	798,660	554,000
1912/13	31,018	104,368	135,386	430,000
1913/14	145,586	638,094	783,680	464,000
1914/15	194,920	331,389	526,309	490,000
1915/16	141,641	655,116	796,757	610,000
1916/17	208,716	302,919	511,635	550,000
1917/18	63,958	234,239	298,197	580,000
1918/19	259,273	565,229	824,502	590,000
1919/20	93,847	168,703	262,550	540,000
1920/21	231,831	316,446	548,277	480,000
1921/22	65,819	200,983	266,802	440,000
1922/23	291,417	690,498	981,915	578,000
1923/24	75,027	236,767	311,794	476,000
1924/25	240,952	520,490	761,442	574,000
1925/26	219,192	392,622	611,814	586,000
1926/27	203,843	529,186	733,029	680,000
1927/28	190,370	500,382	690,752	620,000
1928/29	74,828	125,740	200,568	600,000
1929/30	318,647	610,296	928,943	672,000
1930/31	51,796	201,320	253,116	560,000
1931/32	175,070	760,786	935,856	602,000
1932/33	242,772	244,594	487,366	560,000
1933/34	146,098	781,090	927,188	746,000
1934/35	360,037	503,415	863,452	690,000
1935/36	65,938	232,571	298,509	706,000
Average 35 Seasons	154,735	386,619	541,354	

APPENDIX IV A.

Graph Showing Average Clove Crops per Seasonal Year in 5 Year Periods.



APPENDIX V.

Report of the Manager of Government Plantations.

The Government Plantations in Zanzibar at the beginning of the year extended to 7,100 acres containing 52,227 clove and 126,888 coconut trees. By the end of the year this had been reduced to 6,066 acres containing 47,979 clove and 110,456 coconut trees by the sale of two small plots at Machui, three large plots at Selem, one large plot at Bet-el-Ras and the remains of Kitope; by the handing over of the remainder of Mahonda to the Administration for disposal as small holdings and by the transfer of Walezo to the Medical Department for a Leper Settlement. During the second half of the year 1,200 acres of the Kizimbani Estate came under the Plantation Section of the Department for management and supervision, with a view to its being taken over completely as a Government Plantation at the beginning of 1937.

Government Plantations in Pemba are not considered in this report as they are dealt with by the Agricultural Officer-in-charge, Pemba.

STAFF.

The staff consisted of Manager of Plantations, two Clerks, two Overseers, five Assistant Overseers, and four Junior Assistant Overseers, all of whom drew their salaries from Government Plantation funds throughout the year.

General.—In addition to normal work in connection with Government Plantations and that part of Kizimbani referred to above, considerable assistance was given to other sections of the Department.

CLOVES.

Harvesting.—There was no late or *vuli* crop either in the 1935/36 or 1936/37 seasons, with the result that this paragraph deals with the whole of the 1936/37 season only.

To all intents and purposes the 1936/37 season's crop was a failure, only 306 frasilas of dry cloves being obtained against 13,193 and 933 frasilas in the 1934/35 and 1935/36 seasons respectively. Loss in drying amounted to 66.54%. The mean yield was 0.24 lbs. of dry cloves per tree.

Light pickings started in June, but the harvest terminated abruptly towards the end of October. The picking price remained at 10 cents per pishi measure of approximately 4 lbs. of green cloves, except for the last ten days of the harvest when it was increasel to 12 cents per pishi. Cost of picking, drying and cleaning amounted to Shs. 3.27 cents per frasila.

Condition of Trees.—As a result of the favourable climatic conditions both in 1935 and 1936, all sound trees are carrying a full leaf equipment and are in excellent condition. In areas affected with "die-back", this complaint appears to have been arrested and some of the trees have taken on an improved appearance.

Sudden Death.—Incidence of this has been restricted to parts of Machui and Masingini and one corner of Selem. Regular monthly observations continue to be made in the 800 tree position plot at Machui. The officer in charge of the Experiment Section has reported on these observations but it may here be noted over 29% of the trees have died within 20 months and that 36% died without having been prognositicated.

Cultivation.—With the negligible clove crop it was not necessary to divert the labour gangs to harvest work with the result that a good state of cultivation was maintained throughout the year. The high marked rises mentioned below warranted more intense cultivation which was given.

Supplying.—3,365 selected seedlings from Kizimbani Experiment Station were planted, the holing having been done and reported upon last year. Failure to establish varied from over 25% at Machui to less than 5% at Masingini.

By the digging of holes, preparations for the supplying programme in 1937 have been made. The extent of this work has been limited by the possibility of a short supply of planting material owing to the scarcity of seed due to the smallness of the 1935/36 crop.

Regeneration.—The 22 acres at Dunga referred to in my last annual report were duly underplanted with 1,460 selected seedlings. Failures amounted to about 12%. Eleven acres of this area have been receiving various cultural treatments for the purpose of determining the effect on areas affected by "die-back". In future the effects of these treatments on the young trees will be observed.

Plantation Cloves.—The carry-over of the 1935/36 season's cloves into the 1936 financial year were sold for Shs. 36.70 cents per 100 lbs. The 1936/37 crop was bought by the Clove Growers Association at an average price of Shs. 52.23 cents per 100 lbs. as compared with Shs. 36.40 cents and Shs. 31.9 cents for the 1935/36 and 1934/35 seasons' crops respectively.

Plantation Stems.—The carry-over of stems from 1935 was sold at an average price of Shs. 6.93 cents per 100 lbs. Stems of the 1936/37 crop were sold for Shs. 7.02 cents per 100 lbs. The proportion of stems to cloves for the 1936/37 season was 29.74%. Fees deducted for handling and selling stems in 1936 amounted to Shs. 17.55 cents.

COCONUTS.

Harvesting.—Four quarterly gatherings have been made on all plantations operated. There are now only five coconut plantations operated on which comparisons can be made as on all others production has been affected by sales or exchanges. The production on these five is 9.6% and 22.2% below that of 1935 and that of the previous three years respectively.

The production of all plantations operated amounted to 2,224,319 nuts which added to the carry-over from 1935 of 19,616 nuts amount to 2,243,935 to be accounted for. 1,955,461 nuts, or 87.15%, were made into copra, 266,576, or 11,88%, were sold, 7,295, or 0.32%, were used for seed and 14,603, or 0.63%, were rotten. On the five plantations referred to above, the production averaged 31.7 nuts per bearing tree against 39.4 for the previous four year period.

General Condition of Palms. The general condition is satisfactory, and those near the sea-shore did not suffer unduly during the droughts or wet periods.

Cultivation.—Coconut areas have been kept clean, more by hoeing than by slashing as compared with the past few years. Other routine works, such as ring-weeding, have been undertaken as necessary.

Planting.—The regeneration area at Machui has been extended to 55 acres and holing has been done with a view to extending it by a further 40 acres in 1937. At Selem a planting programme has been arranged, holes having been dug this year, and it is proposed to regenerate an area of about five acres and to undertake a considerable amount of supplying.

Nurseries.—For the above work nurseries have been formed at Machui and Selem. Seed has been selected from well shaped palms which are known to be good bearers. A further selection was made by the discarding of small and or poor shaped nuts.

Sale of Nuts.—Owing to the small production of nuts referred to above it was possible to make a larger percentage of nuts into copra on the existing kilns and with the good prices obtained for copra it paid to transport nuts from outlying heaps to kilns. Consequently the proportion of nuts (11.88%) sold on the heap was below normal. An average price of Shs. 29.11 cents per 1,000 nuts was obtained for the fifteen lots sold, the higtest being Shs. 49.50 cents in December and the lowest 20 in May. The average prices obtained in 1935 and 1934 were Shs. 22.41 cents and Shs. 10.95 cents per 1,000 nuts respectively. As from the 3rd July, all nuts have been sold through our Agents, the Clove Growers Association, who charged 1% commission.

Leasings.—The crops of Town areas and certain other plantations not operated were leased quarterly at an average annual price of Shs. 58.6 cents per palm compared with Shs. 37 and 16 cents for 1935 and 1934 respectively.

COPRA.

Manufacture of Copra.—314.4 tons of copra were made at the rate of 6,219 nuts per ton against 6,180 in 1935. Most of this was made on the sand-bath type of kiln. In the middle of August the new Ceylon type of kiln at Mtoni was completed and the manufacture of copra thereon was started. This new kiln has not proved entirely satisfactory. In spite of dry shell fuel only being used the final product was badly discoloured by smoke and there was a considerable amount of bacterial pitting.

Plantation Copra.—During the year our Agents, the C.G.A. sold 317.7 tons of our copra at an average of Shs. 10.63 cents per 100 lbs. as compared with Shs. 8.45 cents, Shs. 5.36 cents, Shs. 6.50 cents and Shs. 10.05 cents per 100 lbs. for 1935, 1934, 1933 and 1932 respectively. The lowest price realized this year was Shs. 7.15 cents for four bags of inferior and the highest was Shs. 17.35 cents for ten bags of best quality towards the end of December.

The commission charged by the Clove Growers Association on the sale of copra was 40 cents per 100 lbs. to the end of February and thereafter was reduced to 25 cents. Total charges for the year under this head was Shs. 1,832.82 cents.

The net revenue for the year was Shs. 73,801.42 cents, i.e. Shs. 10.38 cents per 100 lbs.

Cost of Manufacture.—During the year 704,277 lbs. of copra were made from 1,955,461 nuts.

		Actual Amount Shs. Cts.	Per Ton Shs. Cts.
Value of 1,955,461 nuts at Shs. 29-11 per 1000	...	56,923 47	181 03
Cost of Manufacture	...	5,865 93	18 66
,, ,, Night-watchmen, bagging, etc.	...	2,846 10	9 06
,, ,, Transport of nuts, outlying heap to kiln	...	570 69	1 81
,, ,, Transport of copra to Town	...	1,473 61	4 68
,, ,, Repairs asd re-construction of kilns	...	1,895 89	6 03
		69,575 69	221 27
Net revenue on 704,277 lbs. copra	...	73,107 88	232 53
Balance available for supervision and profit	...	3,532 19	11 26

In considering the above table, the following should not be lost sight of:—(a) an increase or decrease of Sh. 1 per 1,000 in the valuation of the nuts, augments or reduces respectively the balance by Shs. 6.22 cents, per ton, (b) on a rising market it is more profitable to make copra than to sell nuts as there is bound to be a certain lapse between the nut transaction and the sale of the copra, (c) a local manufacturer in a small way of business could dispense with the services of a watchman and increase his balance by about Shs. 9 per ton, or a manufacturer in a large way would need only one watchman for a greater number of nuts and could reduce the charge under this head accordingly, (d) with the improved price of produce as it stood at the end of the year, the huskers and breakers employed would expect higher rates of pay, (e) the crop was below average for quantity and kilns were kept in operation by transporting nuts from outlying heaps instead of selling them, the charge for transport of nuts being 115% greater than in 1935 on this account, (f) the repairs and re-construction of kilns was 117% greater than last year as this charge covered the cost of the new Ceylon type kiln and is not recurrent.

REPAIRS TO PLANTATION HOUSES.

The only major work was the replacing of the clove pickers shed and the weighing shed at Selem by the construction of a permanent shed made with concrete floor and pillars and C.I. roof at a cost of less than £60.

Other works under the head consisted in the renewal of the roof to the Overseer's house at Machui, and the treating of all other C.I. roofs with anti-corrosive paint; the renewal of the floor of the office-quarters at Machui; and the normal repairs and re-constructions of buildings built of mud with thatched roofs.

REPAIRS TO COPRA FACTORIES.

Normal repairs to sand-bath type kilns have been carried out as required. The construction of a Ceylon type kiln at Mtoni was completed in August, the cost being £58.5 shs. of which £40.16 shs. were spent during the current year. The walls were of brick, faced on the outside with cement reinforced with wire-netting, the copra tables were of expanded metal and the roof was of corrugated iron sheets.

Two old kilns at Selem were in a poor state of repair and, with the sale of large parts of the plantation, became redundant and were demolished.

ACCOUNTING.

As may be seen from paragraph "Staff, General," assistance has been given in various other works, other than Government Plantations. So that the latter should not bear an unfair amount of over-head charges it has been necessary to allocate in Plantation accounting a part of these charges against these works in the same way as they are allocated against individual plantations.

FINANCE.

General.—In preceding paragraphs it has been shown that the clove crop was exceptionally poor and the coconut crop below average. During the year cultivation has been more intense and maintenance of buildings has not been neglected. Nevertheless the good prices obtained for produce sold have been so high that the statement of accounts for the year, which agrees with Treasury figures, shows that expenditure exceeded revenue by only £106.17 shs. This figure is arrived at as follows:—

REVENUE.

		£		
Adjusted revenue for cloves	...	292	73	
Adjusted revenue for coconuts and copra	...	4,483	68	
Miscellaneous receipts	...	79	77	
Total Revenue	...			£4,856 18

EXPENDITURE.

Headquarters division.	Personal Emoluments	...	964	55	
	Other Charges	...	64	54	
Field division.	Personal Emoluments	...	597	75	
	Other Charges	...	3,335	51	
					£4,962 35
				Deficit	£ 106 17

Considering the four year period 1933/1936 inclusive, revenue exceeds expenditure by £2,436.90 shs. but allowing for pension commitments the figure of £2,269.48 shs. is arrived at as shown below.—

REVENUE.

		£		
Adjusted revenue for cloves	...	11,636	28	
Adjusted revenue for coconuts and copra	...	15,587	76	
Miscellaneous receipts	...	373	94	
Total Revenue	...			£27,597 98

EXPENDITURE.

			£		
Headquarters division.	Personal Emoluments	...	4,166	39	
	Other Charges	...	744	36	
Field division.	Personal Emoluments	...	2,957	94	
	Other Charges	...	17,292	39	
Total Expenditure		...			£25,161 08
				Excess	£ 2,436 90
				Pension commitments	£ 167 42
				Net Excess	£ 2,269 48

Individual Plantations.—Attached as Appendix No. Va, is a statement showing the financial position of the principal plantations for each of the four years—1933 to 1936, for the four year period, and the net result for the period after allowing for pension commitments.

Considering the year 1936, it will be seen that only three plantations, namely Machui, Selem and Masingini, show any considerable deficit. In each of these the number of clove trees is equal to or greater than the number of coconut trees, and the clove trees require to be cultivated whether the trees carry a crop or not. Taking the four year period it is seen that each of the three plantations mentioned made a useful profit in spite of the poor clove crops in 1935/36 as well as in 1936/37 and the low market prices for cloves in 1933 and 1934.

Again considering the figures of the four year period, it will be seen that the three plantations of Mtoni, Mazizini and Kigomeni which carry coconuts almost exclusively, have shown deficits. This is in part due to the considerable areas of immature coconuts, which are being maintained, and also to the poor prices for copra in 1933 and 1934.

Dunga is the only plantation which records a steady excess during the four year period and it is interesting to note that the proportion of clove to coconut trees is about 1 to 4.

I. G. C. SQUIRE,
Manager of Plantations.

APPENDIX V A.

FINANCIAL POSITION OF PRINCIPAL PLANTATIONS, 1933-1936.

	1933		1934		1935		1936		4 Year Period		Pension	4 Year Period Nett	
	Excess	Deficit	Excess	Deficit	Excess	Deficit	Excess	Deficit	Excess	Deficit	Commitments	Excess	Deficit
	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.	Shs. Cts.
Machui	—	3,438 12	8,043 57	—	15,376 38		—	1,689 23	18,292 60	—	1,095 00	17,197 60	—
Dunga	1,353 13	— —	5,042 61		159 66	—	2,379 51	— —	8,934 91	— —	284 00	8,650 91	— —
Seiem	—	1,180 20	16,514 71	—		550 35	— —	5,868 64	8,915 52	— —	715 00	8,200 52	— —
Mtoni	— —	1,312 35	— —	1,931 37		251 59	870 42			—	2,624 89	212 00	— —	2,836 89
Chukwani	—	2,436 38		1,946 17	613 88		1,270 62	— —		2,498 35	205 00	— —	2,703 35
Mazizini	42 66			763 23		351 88	—	18 33		1,090 78	23 00	—	1,113 78
Masingini	146 16	—	5,223 18			1,269 86		2,010 20	2,389 28	— —	74 00	2,315 28	— —
Miwani	— —	209 01	—	880 00	868 40	— —	1,333 80	—	1,163 16	— —	95 00	1,068 16	—
Bet-el-Ras	171 63	— —	221 40	— —	387 27	— —	1,312 95	—	2,393 25	— —	76 00	2,317 25	— —
Kigomeni		524 10	— —	543 76	— —	71 79	— —	2 40		1,142 05	47 00	— —	1,189 05
Mean		6,786 61	29,030 64	— —	14,910 12	— —	— —	2,421 50	34,732 65	— —	2,826 00	31,906 65	—

APPENDIX VI.

Report of the Government Chemist.

STAFF.

The Government Chemist was on duty throughout the year. Laboratory Assistant, Mr. A. G. Kark, was on local leave for two weeks in August.

EQUIPMENT.

The "Silverlite" petrol gas plant, purchased in 1935, was erected early in 1936; the Public Works Department laid the necessary mains and distribution pipes for this laboratory and the pathological laboratory of the Health Department, and the plant was put into operation on 17th March. I am glad to record my entire satisfaction with the supply, which has greatly facilitated laboratory work. At the end of the year the supply was about to be extended to the new laboratory of the Government Secondary School.

General equipment has been maintained, the only notable additions being an automatic electric water-still and an electric sodium vapour lamp for polarimetric wok.

CHEMICAL WORK.

The chemical work of the laboratory is summarized below under A. General Analyses, B. Agricultural Investigations, C. Miscellaneous.

A. General Analyses.

The total of samples received was 411, of which 354 were from Government Departments, nine from the Clove Growers Association and 48 from private firms.

A sum of Shs. 327.50 cents was received by Government in fees for samples analysed for the Clove Growers Association and private firms.

The distribution of the samples is shown in the Table.

TABLE.

Department	1st quarter	2nd quarter	3rd quarter	4th quarter	Total
Agriculture ...	11	32	95	85	223
Health ...	—	—	4	14	18
Police ...	1	10	18	24	53
Customs ...	6	10	11	9	36
Other Departments ...	2	11	6	5	24
Total Government ...	20	63	134	137	354
C. G. A. ...	6	2	1	—	9
Private ...	2	27	10	9	48
Total ...	28	92	145	146	411

Details of the Government samples are as follows:—

Agriculture.—Cloves, 15; clove oil, 130; copra, 1; citrus fruit, 53; cattle dips, 11; manures, 3; timber, 8; other samples, 2; total, 223.

Health.—Soda water and sweetened mineral waters, 6; water, 1; milk, 8; other samples, 3; total, 18.

Police.—Opium, 2; bhang (Indian Hemp), 2; liquors. 43; toxicological exhibits. 4; coins, 2; total, 53.

Customs.—Condensed milk, 30; methylated spirit, 5; liquor, 1; total, 36.

Other Departments.—Post Office: medicines, 16; Public Works: building materials, 7; Museum: 1; total, 24.

Notes on the More Important Samples.

Agriculture.—The Inspector of Produce submitted six samples of cloves for moisture determinations. One sample was examined for sea-water wetting, which was proved. Seven samples of cloves were examined in connexion with a case of spontaneous heating of cloves in a godown. The oil content of a sample of cloves dried in a Seychelles-type copra kiln was found to be 19.1%: the cloves were of good appearance. A sample of old clove dust, petals, etc., yielded only 4.5% of oil.

The new clove oil factory of Zanzibar Distillers, Limited, started production in July. The Government Chemist was appointed to issue export certificates of quality in accordance with the terms of agreement of the Company. Sampling was carried out by the Inspector of Produce. Up to the end of the year 130 samples had been examined, representing 62,389 lbs. of oil (clove bud oil, 51,953 lbs.; clove stem oil, 9,505 lbs.; mixed bud and stem oil, 593 lbs.; leaf oil and "tailings", 338 lbs.). The analytical figures obtained for bud and stem oil varied between the limits shown:—

		No. of tests	Clove bud oil.	No. of tests	Clove stem oil.
Specific gravity (15.5/15.5°C.)	...	16	1.0564–1.0601	2	1.0591–1.0605
Refractive index (20°C.)	...	107	1.5316–1.5343	21	1.5352–1.5363
Eugenol per cent	...	107	87.5–92.0	21	91.5–93.0
Solubility in 70% alcohol	...	107	1/0.85–1/1.05	21	1/0.80–1/0.95

Fifty-three samples of grape fruit, of the seven varieties under experiment at Dunga, were analysed, the observations recorded being appearance, colour, weight, diameter, skin thickness, number of pips, juice content and soluble solids and acid in the juice.

Of 11 samples of cattle dipping fluid from tanks in charge of the Veterinary Branch, seven were of correct arsenical strength, and four were too strong.

Four samples of seasoned timbers from stock and four from parts of buildings were tested for moisture content and their reaction to changing humidity conditions was studied. The experiment is in progress.

Health.—Six samples of soda water and sweetened mineral waters from Pemba factories were examined for metallic contamination. The highest amount of copper found was 1/12th grain per gallon.

Samples of milk from supplies offered for sale were taken by Sanitary Inspectors in eight cases where their own lactometer tests in the market gave cause for suspicion. Solids-not-fat (legal standard 8.5%) were deficient in seven samples, the deficiency in one instance benig 43.8%. Despite the presumed addition of water, the fat content of these samples averaged 4.1%: the cows were probably of native breeds which generally give high values for fat and solids-not-fat. The one genuine sample gave fat, 5.35%, solids-not-fat, 9.05%.

Two samples of *tui* (fresh coconut meat grated with water) gave oil 30.3% and 39.7% and oil-free dry matter 5.0% and6.8% respectively.

Police.—Opium was indentified in two exhibits and Bhang (Indian Hemp)—mixed with tobacco—in two.

Of 43 liquors submitted by the Police, 34 were alcoholic and nine non-alcoholic. Twenty of the exhibits came from Pemba and were all strongly alcoholic distilled liquors.

Three exhibits were examined for datura alkaloids with negative results, and a specimen of the datura plant was tested.

One silver coin proved genuine and one bronze counterfeit.

Customs.—Twenty-six samples of imported sweetened condensed milk contained not less than the required minimum 9% of milk fat, the range being 9.0% to 9.8% and the average 9.3%. Three samples of sweetened and one of unsweetened (evaporated) milk failed: they were all of Japanese origin.

Five samples of methylated spirit were found to be correctly denatured but one was insufficiently and improperly coloured.

The alcoholic content of a sample of Goa Ale was determined for duty purposes.

Post Office.—Sixteen Indian and African medicines imported through the post were tested for prohibited dangerous drugs with negative results.

Public Works Department.—Samples submitted included local charcoal, for examination as to its suitability for use in portable producer gas plant; a soil; three pieces of concrete and two of rusted iron in connexion with the failure of an area of reinforced concrete decking at the Wharf.

Museum.—A valuable Arab belt was tested and found to be of silver-gilt.

Clove Growers' Association.—The oil content of four samples of cloves, one sample of stems and three of mixed buds and stems was determined. A clove oil from Bombay was found to be genuine.

Private.—One sample of cloves was analysed for the Distillery.

For a firm engaged in cargo surveys the following samples were examined for evidence of sea-water damage: gunny-bag, 29; cardboard, 1; sugar, 3; paper, 3; sisal, 4; fiberite packing, 1; boxwood, 3.

Two samples of sea-water and one of iron rust were examined in connexion with unusually severe corrosion of rivets on lighters in the harbour.

One hundred and forty written reports were made on the above analyses.

B. Agricultural Investigations.

(a) *Soils.*—Little field work was carried out. One profile at Kizimbani was described and sampled. Two profiles from Pemba, sent down in 1935, were mounted and added to the collection.

Work on a modified technique for the thiocyanate test for soil reaction was completed and the results published (Journal Soc. Chem. Ind., 1936, LV (20), p. 138T.).

(b) *Cloves.—Storage.*—The experiment on the storage of cloves under different conditions, commenced in 1933, was concluded in September and a report was submitted. The experiment, in a modified form, is being continued with the same cloves.

The phenomenon of the evolution of acetic acid from stored cloves, referred to in the 1935 Report, was again encountered. During the investigation of the case of spontaneous heating of cloves in a godown, mentioned in A. above, acetic acid was noted again as one of the products of the fermentation.

Moisture.—The determination of moisture in cloves was investigated by several methods, including distillation with various liquids immiscible with water. An account of this work will be published shortly.

Distillation.—Various laboratory methods for the estimation of oil in cloves, etc., were compared, and a description of the apparatus and technique adopted was published in the "Perfumery and Essential Oil Record" (October, 1936) as the first of a series of papers on "Studies of the Clove Tree and its Products".

Pot Experiments on Clove Seedlings.—The original experiment, which had given the Silviculturist some useful preliminary data, was discontinued in May, and a new series was started at Kizimbani in August.

Tree Injection Experiments.—Preliminary trials to find a satisfactory technique for the injection of nutrient solutions into clove trees were carried out at Kizimbani.

Clove Oil.—Fractional distillations under vacuum were carried out on clove oil and clove leaf oil, and a quantity of pure eugenol was prepared.

(c) *Other Products.*—Several samples of nutmegs and mace were distilled and the oils characterized.

C. Miscellaneous.

Several standard solutions were made up for the Pathological Laboratory of the Health Department. At the request of the Medical Officer, Government Hospital, a set of standard buffer tubes for urine reaction determinations was prepared, and a special lotion was made. On two occasions, in the absence of the Pathologist, the Government Chemist supervised tests on blood and urine.

For the C. I. D. a quantity of finger-print powder was prepared.

OTHER WORK.

A stereoscope was constructed for examining aerial photographs of agricultural areas.

Film captions and an article were written for the Johannesburg Exhibition.

At the District Agricultural Show in September a small-scale demonstration of clove oil distillation and exhibits of clove products, soil profiles and maps, etc., was staged.

In November, at the request of the Medical Officer of Health, a course of six lectures on Air and Water was given to Sanitary Inspectors and other members of the Health Office staff.

A design for a laboratory for the Government Secondary School was prepared in 1933, and assistance was given during its construction and fitting this year.

The Government Chemist was appointed a Member of the Board of Management of the Clove Growers Association in July and attended all subsequent meetings of the Board.

L. W. RAYMOND,
Government Chemist.